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✓ **NASA CR-170430**

**FINAL REPORT**

**June 1, 1981 - June 30, 1982**

**CONTRACT NAS5-26619**

**IUE STUDIES OF X-RAY K-M DWARFS**

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## FINAL REPORT

CONTRACT NAS5-2661y

This informal letter sets forth the general aspects of contractor accomplishments during the period of performance.

Following acceptance of the proposal made in 1980, six shifts of IVE guest observer time were assigned to the Principal Investigator in the period June 10-June 14, 1981. This time was spent successfully with the PI present during all shift hours, ably assisted by IVE staff.

Out of a potential list of 20 red dwarfs, all within 25 pc but some still quite faint, and selected to coincide as much as possible with a previous Einstein X-ray observing program, LWR exposures were actually made of 13 targets and SWP exposures of five of them. In some cases exposures were made in both large and small focal-plane apertures, and in some cases more than one large aperture exposure was required to reach good enough S/N, but the failure rate was in the end nil. In due course the GSFC hardcopy and Photowrite data reductions were received and studied.

Both continuum and Mg II line emission were detected in the LWR, but little else in that range, while in the SWP range up to 12 emission features could be seen on the Calcomp tracings and confirmed on the Photowrites. Stellar Lyman alpha could be seen superposed on geocoronal Lyman alpha on four of the five SWP images (Kapteyn's high velocity star missing out). Measurements of the tracings have been reduced to line flux densities ( $\text{ergs cm}^{-2}\text{s}^{-1}$ ) and a continuum flux density ( $\text{ergs cm}^{-2}\text{s}^{-1}\text{\AA}^{-1}$ ) around 2660 A.

These flux densities have been intercompared, compared with the bolometric flux density of the stars, and compared with the X-ray flux density of the stars.  $F_X/F_{M_2 \text{ II}}$ , for example, grows with advancing spectral class down the main sequence, and this tells something about the relative power outputs of the coronae and chromospheres of these stars. It may be a logical function of stellar radius, taking chromospheric activity as a surface phenomenon and coronal activity as a volumetric phenomenon.

The analysis of the IVE results is still in progress, and it is aimed for an invited paper at the forthcoming IAU Colloquium 71 on "Activity in Red Dwarf Stars" to be held in Catania, August 10-13, 1982. The paper should appear in an IAU publication from Reidel as the colloquium proceedings. An abstract of the work that has been requested for distribution at the meeting is appended to this letter report. It will be apparent that much integration with Einstein data will be made. Although the PI feels that this contribution will be significant, it seems clear that much more effort on red dwarfs will be needed with the IVE for the further clarification of the complex behavior of red dwarf atmospheres. It is certain that the IVE has been a large factor in the revival of interest in the lower end of the main sequence of stars in our neighborhood.

Abstract for "Einstein and IUE Observations of Nearby Red Dwarfs," an invited paper to be presented at IAU Colloquium No. 71, Catania, 1982 August 11-13.

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Representative samples of stars have been selected from the Catalogue of Stars within twenty-five parsecs of the Sun by Woolley et al. (1970) and observed as Einstein X-ray images and, in some cases, also as IUE ultraviolet spectra. Early Einstein guest-observer results for 16 IPC targets and five HRI targets have been published in *Astrophys. J.* 243, pp. 234-243 (1981). The present Einstein guest-observer work adds 15 more IPC targets, while the IUE guest-observer work now provides spectral information for 13 of the total 29 IPC targets. Most of the stars are red dwarfs, but, since the data base was representative of the nearby stars, they are not all "active" red dwarfs. The extended IPC target list includes Gliese-Woolley Nos. 9066, 191, 206, 293, 334, 402, 440, 447, 9400AB, 576, 628, 9566, 861, 866, and 905. The IUE list includes Gliese-Woolley Nos. 9066, 191, 319A, 412A, 9400AB, 576, 628, 9566, 644AB, 783A, 820A, 860A, and 866. There are also independently published IUE spectra for Gliese-Woolley Nos. 15A, 144, 440, and 820B from the whole present IPC target list.

This paper presents tables of X-ray and ultraviolet data together with various optical data. Some of the results are given in figures. Certain flare-star and BY Draconis-type variable star data are included. The results are discussed in terms of parameters of interest such as rotation and binary incidence. Deviations from correlations of properties that are found in the literature are noted, for example the significance of the 120-day period of the BY Draconis star Ross 248 in the  $v_e$ ,  $L_x$ -diagram.

The fairly sizable number of red dwarfs that have been observed both with Einstein and the IUE enhances the value of the present set of data. The two satellites respectively yield information about the coronae and the chromospheres or transition regions of the nearby stars.